FOREST PEST MANAGEMENT
Pacific Southwest Region

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Evaluation of Leafy Mistletoe on the Shingle Springs Rancheria, El Dorado County, California

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INTRODUCTION/BACKGROUND

On May 9, 2000, we visited the Shingle Springs Rancheria just west of Placerville off State Highway 50. Also present were Jeff Murray, Rancheria Project Officer; and Kim Newbauer, Bureau of Indian Affairs, Pacific Region Timber Sales Forester. Our purpose was to assess the severity of oak mistletoe (also called true or leafy mistletoe) infestations in native oak species and discuss options for managing this disease.

The Rancheria contains approximately 160 acres of foothill forest land that has been divided into residential parcels between 2 and 6 acres. The forest canopy consists primarily of interior live oak, California black oak, blue oak, gray pine, California buckeye, and some ponderosa pine at the higher elevations. Manzanita, toyon and poison oak make up the understory. Much of the Rancheria was burned, and subsequently salvage logged in the 1960's. The young stands now have oaks generally between 20 and 40 feet tall with scattered larger trees (mostly pines) that survived the burn. The main objectives of vegetation management on the Rancheria are to preserve the existing overstory, reduce understory fuels and create defensible space in the case of wildfire.

OBSERVATIONS

The distribution and severity of oak mistletoe (*Phorodendron villosum* ssp. *villosum)* infections varied greatly within the Rancheria. (See the discussion of mistletoe biology at the end of this report.) Black oak and live oak were the tree species with the most disease. At the

worst sites, true mistletoe was present throughout the entire crowns of oaks, causing branch dieback, crown decline and in a few cases, whole tree mortality. Over time this parasite will continue to intensify within infected trees and spread to healthy trees. Annual precipitation in central California over the past several years has been normal or above and favorable for host trees. During periods of drought, the negative effects of mistletoes on their hosts are enhanced. Past and future efforts by the Rancheria to remove understory fuels will help to reduce competition for moisture between vegetation. This should also improve the health of oaks infected with true mistletoe.

Varying levels of defoliation were observed on scattered, individual, California black oaks. This defoliation was due primarily to larval feeding injury by the fruittree leafroller, *Archips argyrospila* (Lepidoptera: Tortricidae). This insect has a transcontinental distribution and feeds on a variety of hardwoods throughout the U.S. Populations generally occur at low levels but can periodically increase to high levels for short, usually 1 to 3 year, periods. Light to moderate feeding injury has little negative impact on the health and vigor of the host tree. Significant damage occurs only with repeated, heavy, defoliation. Such defoliation may predispose the weakened trees to attack by secondary oak bark beetles and woodborers. Host condition can also be important; a healthy vigorous tree will be able to tolerate a given level of defoliation better than a tree stressed by any of a number of factors, including drought, leafy mistletoe and overstocking. Similar defoliation to California black oak has been evident in the Sierra Nevada foothills from Eldorado Co. to Tuolumne Co. over the past two years. In addition to the fruittree leafroller, the Pacific tent caterpillar, *Malacosoma constrictum* (Lepioptera: Lasiocampidae) has also been associated with some of the defoliation.

DISCUSSION/MANAGEMENT

True Mistletoe

The severity of mistletoe infections at some sites on the Rancheria is serious enough to warrant treatment. Individual tree values are very high because each parcel is designed for residential development. Several options for controlling true mistletoe are available and described below. No single option will be the most appropriate for all situations, and all of the options listed will reduce the amount or effect of mistletoe to some degree.

1. **Remove true mistletoe plants.** Cutting off mistletoe plants flush with the branch will set back the parasite and prevent fruit production for at least a year. This treatment does not kill the internal portion of the mistletoe and it will eventually re-sprout.

2. **Remove mistletoe-infected branches.** Pruning out infected limbs can remove both the internal and external portions of the mistletoe, which prevents re-sprouting. The pruning cut should be at least one foot below the point of mistletoe attachment, preferably the nearest crotch or bole. This treatment is more effective than removing just mistletoe plants, but is not appropriate for trees with heavy infection where too much of the crown would be removed.

3. **Chemically remove mistletoe plants**. Florel[7] is the only product registered by EPA and California to control mistletoe. Its active ingredient is ethephon, which when applied to mistletoe plants, causes them to fall off. This is like cutting off the plants, except that it can be done from the ground. The chemical does not kill the internal portion of the mistletoe, which means that re-treatment will eventually be required. (A specimen label is included at the end of this report.)

4. **Remove trees**. A few oaks on the Rancheria are so heavily infected that their survival is in question. If the mistletoe was removed there would be almost no live crown left to support the tree. In these situations it is best to remove the entire tree.

5. **Plant resistant trees**. Openings created by removing dead or severely infected oaks could be planted with species resistant to *P. villosum* ssp. *villosum*. Most species of oaks are susceptible to the true mistletoe present on the Rancheria, but other hardwoods and all conifers are resistant.

Fruittree Leafroller

Although the fruittree leafroller generally does not cause significant damage to host hardwoods, heavy defoliation, particularly if repeated in consecutive years, can have negative impacts. This can be of particular importance to landscape or ornamental trees and/or trees located around homes, recreation areas or administrative sites. Impacts can include temporary loss of shade and reduced aesthetics, minor nuisance due to larvae dropping from trees on silk threads and, infrequently, branch dieback or tree mortality. Defoliation can be largely prevented by the timely application of insecticides including the naturally occurring bacterium, *Bacillus thuringiensis* var. *kurstaki.*

BIOLOGIES OF PEST ORGANISMS:

Mistletoes.

These are seed producing plants that parasitize other higher plants. Two groups of mistletoes are common on trees in North America - the true, or leafy mistletoes (genus *Phoradendron*) and the dwarf mistletoes (genus *Arceuthobium*).

The true mistletoes obtain all of their water and minerals from the host, while the dwarf mistletoes obtain all their water, minerals, and nutrients from the host, which makes them more damaging to their host. True mistletoes can carry on photosynthesis whereas dwarf

mistletoes cannot. The table below summarizes other major differences between the two groups.

	TRUE	DWARF
AERIAL SHOOTS:	Large and Leafy	Small and Leafless
PLANT SIZE:	> 6 Inches	< 6 Inches
HOSTS:	Hardwoods & Conifers	Conifers Only
SEED SPREAD:	Birds	Forcibly Ejected

True Mistletoe

True, or leafy, mistletoes are parasitic plants in the genus *Phoradendron* with mature shoots more than six inches long. The size of their shoots help to distinguish them from dwarf mistletoes. The foliage of true mistletoes may be leafy or scaly, and their fruit is a round berry. They are mainly parasites of hardwoods but also infect several species of conifers in California, and obtain water and minerals from their host.

This pest is spread mainly by birds, including robins, bluebirds, thrushes, and cedar waxwings. Birds feed on the berries, digest their pulp, and excrete the living seed, often depositing them onto suscept- ible trees. A viscous coating and hair-like threads on the outer surface of the seeds attach them firmly to twigs and branches, where they germinate and infect host tissues.

Young or small trees are seldom infected by true mistletoe. In nearly all cases, initial infection occurs on the branches of larger or older trees because birds prefer to perch in their tops. Severe buildup of mistletoe often occurs in an already-infected tree because birds are attracted to and may spend prolonged periods feeding on the mistletoe berries.

True mistletoes are often considered to be curiosities, but they can be serious pests where individual trees are of high value, as in yards, parks, and campgrounds. Heavily infected trees are weakened, reduced in growth rate, and sometimes killed. Weakened trees are predisposed to attacks by insects and often die during drought or other periods of stress. Branches and tree tops heavily-laden with true mistletoe often break during wind storms, increasing the hazard to people and property in campgrounds and other developed sites.

Fruittree Leafroller

The fruittree leafroller, *Archips argyrospila* (Lepidoptera: Tortricidae), feeds on a variety of hardwoods throughout the U.S., including aspen, birch, maple, elm and California buckeye as well as a variety of oaks. The taxonomy is incompletely understood, and the group may be a complex of species or subspecies. The fruittree leafroller completes one generation per year. The adults are small, rusty brown to tan colored, moths with a wingspan 20-25 mm. Depending on the year, the adults generally fly from May into August. Eggs are laid in irregular flat masses covered with a whitish cement on host tree twigs and branches. There

are 50-100 eggs per mass. The eggs overwinter and the larvae emerge in the spring, generally from March to May, although hatch has been observed as early as January.

After hatching, the larvae move to the leaves where they feed. They often roll the edges of one or more leaves and tie them together with silk to form a protected cavity or nest. Population densities can vary widely from year to year. During periods of high population densities, host trees can be heavily defoliated by larval feeding. Extensive silken webbing is often evident throughout the crown of the tree, on nearby plants and on the ground beneath the infested tree. Mature larvae are about 20-25 mm in length and light green in color with a shiny black or brown head. Typical of this moth family, the larvae will wriggle energetically when disturbed and are often found hanging from the tree on silken threads. The larvae pupate in late-spring or early-summer. The light to dark brown pupa, usually about 11mm in length, are frequently formed within the rolled leaf nest.